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Colour in Schools

By DAVID MEDD, A.A.Dipl., A.R.I.B.A.

Summary

The following is the opening contribution to a discussion on the Ministry of Education Building Bulletin No. 9 on Colour in Schools. After explaining the object of the Bulletin, the functions of the architect and lighting engineer in this field and the importance of colour on both aesthetic and functional grounds are discussed. Factors to be considered in the selection and use of appropriate colours are also discussed.

The Ministry of Education Building Bulletin No. 9 (Colour in Schools) has been a particularly difficult one to write because colour is a subject which is largely associated with feelings rather than with facts which can be clearly stated, and because the Bulletin cannot pretend to be more than a vehicle for the expression of the views and experiences of a small number of architects. These views being largely matters of personal opinion could, perhaps, have been more freely stated in an architectural journal than in an official publication for H.M.S.O. However, it was considered that the publication of the ideas and experiences of some would be of help to others faced with the same problems. We do not want the Bulletin to be regarded as a normal official document, and everything in it to be taken as gospel by which the Minister will stand or fall.

I shall never forget the feeling of loss when confronted with our first school after the war, for which a colour scheme had to be designed. Here was the beginning of a large programme of school building, and although I was aware of the enormous opportunities, I was appalled not only at the lack of guidance on the subject of colour scheme design but also at the absence of suitable colour ranges. What one can read on the subject is largely irrelevant to the subject of colour and buildings. On the one hand there are the enthusiastic but sentimental views of art teachers and the fashion artists, and on the other the work of the paint technologists and colour scientists. This leaves a wide gap in the field of colour-scheme design and application. It is in this gap that I am particularly interested, and I hope the Building Bulletin will be regarded as a useful attempt to fill the gap. I hope that others will discipline themselves to set down their thoughts and experiences, so that some principles and guides to the design of colour schemes can become established and readily understood and appreciated by the thousands of persons who are colouring our environment, and who do not really know why they choose the colours they do. The design of a colour scheme must, I feel, be both an analytical and an imaginative process. In writing about colour one can assist the designer to analyse the conditions that confront him, and go some way to ensure that his choice of colour is reasonably appropriate. Whether the scheme is really beautiful depends partly on the instrument or colour range with which he is working, but far more important, of course, on his own colour sense. If we can establish some principles, a methodical approach, or a sort of child's guide to colour design that does not set down rules or recipes, we shall be doing enormous good. We hope that the Bulletin is a beginning in this direction. The brilliant designers and artists can look after themselves, but I am bound to say that however sure the colour sense of an artist may be, he may not be able to put his colours in the right place. In building we are concerned both with the relative and absolute values of colour, so that a good colour may be a bad colour in the wrong place.

Mr. Medd is with the Architects and Building Branch of the Ministry of Education. This discussion took place at a joint meeting of the Society with the Royal Institute of British Architects held in London on February 10, 1953.

(1) Summary of Bulletin

The Bulletin is divided into two parts. The first, after stressing the importance of a methodical approach to the problem, outlines in general terms the factors to which colour choice must relate, such as the occupants of the building and their activities, lighting and vision, and the form of the building elements. The second part, also in general terms only, makes a case for a methodical system of referring to colours, and the need for a colour range. It then proceeds to describe the range which has been called the " Archrome " Range, and which is illustrated by small colour chips in the Bulletin.

Then follow seven appendices, in which each of the aspects mentioned above are discussed in more detail. The reason for this separation between Parts 1 and 2 and the appendices, is that the more detailed and personal views which are contentious can be confined to the appendices, leaving the more general material by which the Ministry must stand in the body of the Bulletin. I need hardly add that this compromise solution was not reached until after both architects and administrators had almost thrown their hands in more than once. The architect's determination to put all he knew in, and the administrator's determination that the Minister should not be embarrassed, proved nearly irreconcilable.

I cannot now go through all the contents of the Bulletin which you will be able to read, but I would like to take this opportunity of underlining some of the views which perhaps have not been stressed enough in the Bulletin and which are more particularly architectural and personal views.

(2) The Architect and the Lighting Engineer

I want to start by making a plea for the closer co-operation between the lighting engineer and the architect at the early design stage of a job. Architects need to take advice on the best way of achieving the right quantity and quality of daylighting. In planning windows and other direct sources of light we should at the same time make definite assumptions on the contribution we are expecting from indirect sources. We are, therefore, at this early stage, making decisions about the reflection factors of surfaces which, of course, are imposing conditions to be satisfied later by the choice of colours. This, it seems to me, is the right way to work rather than to ask the lighting engineer at the end of the job what reflection factors he should choose in order to achieve a given level of illumination. We find, therefore, that colour choice is not entirely the prerogative of the architect or decorator.

The architect wants to feel he is free to design in terms of light and shade with certain aesthetic considerations in mind which I shall enlarge on later. Brightness contrasts that would be intolerably disabling in certain spaces may be quite justifiable in others. Architects see in " Brightness Engineering," particularly as exemplified by American engineers, a restrictive attitude of mind which, in its anxiety to remove any possible cause of discomfort, will result in spaces that are very dull and at best be good for sleeping in. In working areas I am well aware of the importance of grading brightnesses carefully, particularly on large surfaces, but if carried to excess on small surfaces, and if the clear articulation of surfaces at different angles and on different planes is removed, the interior will be very lifeless.

It seems to me that a much more positive approach is being made by engineers in this country, and some of the work I am aware of should definitely increase the scope of colour use which at present is limited for many by ignorance and convention.

(3) Visual Interest

We must first of all admit the importance of colour on both aesthetic and functional grounds. It is not just a question of covering blemishes on plasterwork or providing a surface which can be washed down occasionally. In witnessing an

uncoloured building being painted one sees the building coming to life. It gradually ceases to be merely a formal arrangement of doors, windows and walls, and begins to become an environment in which people can do the things that they are supposed to do in the building comfortably. Colour is something we feel like heat and cold, and bad colour causes discomfort in the same sense that being too hot or too cold does.

The eye yearns for visual interest, and it is one of our duties as designers to provide it in degrees appropriate to each situation. In Victorian and Edwardian times we suffered from a surfeit of visual interest in decoration, so much so that every square inch of every object from a ceiling to a tea plate was decorated to a degree that was nauseating. Leading architects in the twentieth century have reacted against this and visual interest was spring-cleaned away in a wave of purism. This only gave satisfaction to intellectuals, and the division between the designer and those whom he should serve widened. Many buildings to-day also lack visual interest through lack of imagination and an attitude of mind that says it must cost money, with the result that all that is achieved is cream walls and mottled floors, relieved by fluorescent light fittings and green woodwork. However, there are signs that designers are realising that modern architecture is starved of visual interest, and that a form of decoration and enrichment must be established which springs naturally from present-day materials, techniques and economy. This is the right way and the difficult way. The easier way is to revive clichés from earlier periods or to invent them.

The provision of visual interest becomes easier if we are prepared to exploit a wide range of textures, colours and materials—in other words to avail ourselves of all the instruments in the orchestra. Colour is only one of the instruments in the orchestra, and its part has to be designed together with others. The device of contrast to produce visual interest is one that can be used more—the contrast of painted surfaces against surfaces of natural materials such as wood, brick and stone; the contrast of smooth textures against rough textures; the contrast of bright colours and dull colours; the contrast of pale colours and dark colours; the contrast of colours and neutrals; the contrast of small-scale pattern against large-scale pattern. We have to decide where large-scale pattern and where small-scale pattern is appropriate. We have to decide whether the effect of pattern is to be a tickle or a bold punch. There is also the contrast in levels of illumination and qualities of light. This design scope is vast and is insufficiently appreciated by many designers. Too many of us use only the middle octaves in the scale, so to speak, and are frightened by the warnings of danger sounded by technical experts if we go to extremes. However, we shall not achieve visual interest in our buildings until we, as architects, are able to use the whole scale from the smoothness of glass to the roughness of stone, from the darkness of deep shadow to the brightness of the sun, from the delicacy of pink to the boldness of scarlet, from the blackness of black to the whiteness of white.

Having (mentally, at any rate) achieved this freedom, you on the lighting side will quite rightly hedge us in with warnings and say this freedom is dangerous. I realise it is dangerous, but it is essential for good and interesting design. I know I must grade my brightnesses on window walls, and that I must grade my brightnesses round chalkboards and other centres of visual attention. I know that I must avoid excessive contrasts in these places if I am not to suffer from glare or find attention on a particular object difficult and uncomfortable. However, all interiors do not consist of these conditions, and the size scale of contrasting elements must be considered. The smaller the elements the stronger can be the colour or light and shade pattern contrasts. The permissible, and I think visually important, contrasts between the light and shade on radiators, louvres, venetian blinds, perforated materials, are far greater than the limits that should be prescribed for contrasts between areas of wall between windows and the windows themselves. I feel that brightness limitations should not only be related to size, but also to position in a room, and

the kind of room or space. Stronger contrasts are permissible, and I think are more valuable, at low level in a room than at high level, just as they are more justifiable in entrance halls and circulation areas than in workrooms and teaching-rooms. Please do not think I am encouraging architects to take an irresponsible attitude to " brightness engineering." I only want to emphasise the fact that there are many different situations in a building to be exploited, and our buildings will be very dull, as most are, if we apply the same criteria to all situations.

I should like to continue this plea for the sensible exploitation of contrasts for the sake of visual interest in design into the field of daylighting. In rooms or spaces where good vision is of prime importance the architect, with the help of the lighting engineer, must deploy the light sources to ensure not only adequate illumination whenever required, but a balancing of sources to avoid brightness contrasts that will cause disability or discomfort. He must also realise the effect of these sources on the reflectances of colours he will be using. He must ensure that if any area is being preferentially illuminated, it is an area that requires it. Too often in classrooms, for instance, the position of supplementary toplights is determined by the requirements of ventilation or the straightening out of the sky factor line, so that they do not preferentially illuminate that part of the room which is the chief focus of interest or attention.

Having given first importance to good vision in workrooms, there remain many other parts of buildings where the architect can be just a little more bold, daring or dramatic in his use of daylight. Acute vision is less important in entrance-halls, circulation- and cloak-rooms, dining-rooms and even assembly-halls. In schools these spaces are tending to become one complicated and interconnected complex of space design. They can be spaces of great visual interest. The whole complex should be visualised in the architect's mind as one. It will certainly not be evenly illuminated and would be very dull if it was so. It will be a complicated light and shade pattern, with views through from one space to another; some areas will be very light, some areas will be relatively dark, some walls will be in shadow, and some walls will be deliberately preferentially light. Where one is not so controlled by the requirements of acute vision one can, and should, design freely on the light and shade scale. Contrast top light with side light, high-level sources with low-level sources. I think spaces that are worked out on these lines will have very considerable visual interest, with some areas deliberately in shadow to heighten the effect of nearby spaces that are more brightly lit. The device of passing through a low, relatively dark lobby, anteroom, or space into a taller, highly lit space is a common and interesting one. The effect of one increases the effect of the other. It is important in these complicated spaces where there are long views, that they should end by a focus of relatively brightly lit surfaces, otherwise the long view will peter out vaguely and the whole space will not be seen in focus.

It is clear that the design will have been worked out with a deliberate light and shade pattern in mind. It is important that the choice of colour should go further than merely preserving this light and shade pattern, but should help to express it more clearly than it would be expressed were all the surfaces white, when inter-reflections would tend to even out designed contrasts and the eye would wander with no foci to rest on. Therefore we choose colours that reflect a high proportion of light on surfaces that are well illuminated and colours that reflect less light on less-well-lighted surfaces. In this way the effect behind the design conception is clarified and heightened. It is in these central areas of large communal spaces in schools where there is contrast movement and activity that bright colours can justifiably be used. You are probably well aware of this tendency. This freeing of colour use is fraught with danger. Bright colours can " sing " provided they are insulated from one another by extensive areas of white or pale near-neutral colour. On the other

hand, used in the way that one normally handles pale wall colours they are far too overpowering. With careful treatment, therefore, these large central spaces can be stimulating by virtue of the staccato effect of bright colour accents. This is quite different from the more symphonic use of colours which blend together more gently, and give a character which is more appropriate for working and domestic areas. I must utter a warning that this sympathy of colour to light-and-shade idea must never be applied to the shaded areas on window walls or other situations where uncomfortable glare contrasts would be aggravated. We begin to see now the power of the colour weapon with its ability to make light surfaces appear darker and dark surfaces lighter. We have therefore to examine our light and shade pattern and decide in each case what we want the colour to do with it. Do we want to express it more clearly or do we want to submerge it? Colour has to be controlled very carefully because it can work in two opposite directions, and sometimes one direction is right and sometimes the other. I have deliberately stressed the use of colour in sympathy to light and shade because colour is so often considered in terms of its ability to reduce contrasts or to correct conditions arising out of a design which otherwise would cause discomfort. When colouring existing buildings one is continually having to use colour with the object of correcting glare contrasts or reducing the appearance of ugly proportions and shapes. Speaking of the use of correction by the use of colour reminds me of the effect of morning sunlight, mid-day sunlight, evening sunlight and north light, which some feel should be "corrected" in the colour scheme. What is the assumed ideal to which these effects should be corrected? As an architect wanting to make buildings visually interesting I want to deliberately exploit these gifts from nature. It is presumptive, I feel, to consider that they can be corrected. I readily admit, of course, that the sun's rays have to be prevented from interfering with visual tasks, but we do not want to exclude the sun's rays from all rooms all the time or from some rooms at any time. In fact, it is very often the reverse.

(4) The Effect of the Building Design on the Colour Scheme

Having attempted to outline this idea of visual interest in building design, and the part that lighting and colour can play in achieving it, I want to say a few words about another aspect of design for colour as seen from an architect's point of view. I refer to the degree to which a colour scheme is determined at the early stage of the design of a building. The extent to which the colour scheme is being affected by decisions taken at the early-design stage is not realised sufficiently. We have already seen that decisions on lighting design affect the reflection factors of colours, but there are other factors at work, too. In positioning columns, doors, and partitions, and in designing and positioning windows, one is designing the surfaces to which colour is to be later applied. One is, therefore, both imposing limitations on colour choice and creating opportunities for colour expression. The more one relies on colour for raising the daylight factor, the more limitations on colour choice one imposes. By leaving proportions of wall areas to chance or by not realising the effect of doors on wall proportions, one may be creating shapes which one would be loath to accent by strong colour, even though the position of the wall would justify strong colour. To be aware of these factors only at the end of a job when the colours are actually chosen is too late, and, as this is a common state of affairs, it is one explanation why one does not often see buildings where the colour and the form and the lighting are part of one conception. Do not let me give you the impression that I am being idealistic, because I do not think there is any necessity at all to choose colours at the early-design stage, *so long* as one realises that at this stage one is determining its characteristics, particularly in terms of the reflectance of the colours, and that

one may be creating formal conditions which prevent the best colour treatment being carried out.

One or two examples may make this point clearer. Let us take a teacher's chalkboard wall in a classroom. To assist comfortable attention on the board the greatest contrast in the field of view should be between the chalk itself and the chalkboard surface, while the contrast between the board and the surrounding wall should be less. This means that the Munsell value of the wall will probably be 6 or 7. If value 6 is taken right to the window wall and the window goes right into the corner, one may well be causing disability glare between value 6 and the sky. If one uses value 8 or 9 this condition will be satisfied, but contrast with the chalkboard will be too great. One is left with two alternatives: either to stop the window short of the corner (I am not sure how far, but I guess not more than two or three feet), or to have a margin of light colour at the edge of the chalkboard wall—in other words, a kind of vertical dado, which on formal grounds to me is quite indefensible; changing colour without a change in plane disrupts form rather than clearly expressing it (in other words, camouflage). This vertical margin is something that must be considered and planned for at the early-design stage, either by columns forming a natural division between wall panels of different colour, by a doorway or by the position of light source.

In designing a building we want to be sure we can change a colour where necessary. A wall surface may continue from an entrance hall along a corridor. We may want a strong colour in the hall which would be intolerable were it to continue down the corridor. I have already suggested we cannot change colour without a change in plane, so some provision has to be made. In buildings of frame construction the regular expression of columns as pilasters divide the wall into a series of panels at any one of which colour changes can easily be made. Where walls are not so divided, there may be difficulties, and in these cases I think it is important to take the door frame up to the ceiling and have a fanlight or panel between the ceiling and the door transom at 6ft. 6in. In positioning these doors one is therefore determining the proportions of rectangles to be coloured. Door frames that do not reach the ceiling give inverted "U" shapes, and similar door frames at internal corners given inverted "L" shapes. Being sensitive about these shapes is comparatively unimportant where pale colours are used, because these shapes will not be emphasised. The use of strong colour, however, means that one has to be all the more careful about the proportions of areas on which they are used. I think that rectangles that are either very vertical or horizontal in proportion are less comfortable when very clearly expressed by colour than near square proportions. Therefore, in areas where it is known that strong colour is to be used, and adjacent to areas of concentration such as chalkboards, it is particularly important to avoid strange or uncomfortable proportions or one may be preventing oneself from using the right colour. Where clerestory windows are used it is important to have a sill margin of white, preferably steeply splayed inwards to grade brightness contrasts. This effects an important constructional detail. Moreover, this sill should project beyond the wall surface below it making a horizontal painting line, so that a dark colour can be used on the wall if required.

Having now introduced two subjects, visual interest and the extent to which a colour scheme is determined at the early-design stage, I want to conclude by touching very shortly on two aspects, firstly the need for a colour range for architects, and secondly the value of the Munsell system for architects.

(5) Colour Ranges

I mentioned earlier in my talk that for the first school with which I was concerned it was not possible to find a range of colours that had been designed for use in buildings, so that all one could do was to use manufacturers' shade cards, the B.S. range,

or waste hours of time arranging for a series of special colours to be mixed. No design tool existed. It was like playing a tune on a piano with a lot of notes missing, with some in the wrong order, and with several of the keys giving almost the same note. As a newcomer to architectural practice since the war it seemed incredible to me that we should have gone on so long without this instrument. A group of architects in a local authority, together with manufacturers, worked out a range of colours to make it possible for an office to cope with the colour requirements, both administrative and aesthetic, of a large building programme with reasonable efficiency. Thinking that this work might be of wider use, the Ministry of Education collated the experience to date, and after some further development published it in the Building Bulletin. The range has been designed with school work particularly in mind, and we realise that it should be modified and extended if it is to be of wider use. Fortunately, this work is being undertaken at the moment.

There are 47 colours in the Archrome range—a number I feel that is large enough to have alternative colours in each important use category, and small enough to be economic to produce and to grasp mentally and know well by heart. It was felt that there should be good representation in that part of the colour field which it was known could be reproduced by reliable pigments, and that there should be known uses for each colour. There are alternative colours of high value and low chroma (value 9 and chroma 2) for the pale wall colour category; there are alternative colours of lower value and low chroma (values 6, 7 and 8 are chromas 2 and 4) for the background wall category; there are alternative colours of middle value and middle chroma (values 5 and 6 and chromas 6, 8 and 10) for small wall areas and the panel accents category; there are alternative colours of low value and low chroma (values 3 and 4 and chromas 2 and 4) for chalkboard and heavy colour category; and finally there are a range of very high chroma colours centrally chosen in each important hue group (i.e., yellow, orange, red, blue and green).

There are some colours that have been deliberately omitted—the unreliable violets and purples and others that are known to be difficult to use in practice. There is a deliberate bias towards warm colours that are commonly found in nature as it is felt that they are more readily appreciated, and that they blend together more easily. Great importance was attached to a harmony or family resemblance between all the colours in the range. Each colour was considered not only in relation to its main use category mentioned earlier, but in relation to each other colour. To assist this aspect of the design all the colours were obtained from eight basic pigments. This " family resemblance " between all the colours in the range is particularly important where there are likely to be several different colours in the same field of view—a condition frequently occurring in schools.

Experience in the use of the range, the more recent work now being done on colour range design, and the consideration of building types other than schools has revealed a number of limitations in the range, particularly in the very high values, value 7, and the very low chromas between values 5 and 9. However, despite these deficiencies, which we hope will soon be made good, we do feel there is for the first time a range of colours that covers all the main requirements for use in buildings which is designed so to speak as a tuned and calibrated design instrument. I would like at this point to say that the Building Research Station has and is taking a leading part in the colour range work of which there is still much more to do. They are also concerned with colour specification, and by laying emphasis on the use of the Munsell system are helping to unite the work of the architect and the lighting engineer.

(6) The Munsell System

This leads on to the Munsell system whose references have been given to each colour in the Archrome range.

The advantages of unambiguous references to colours need no stressing, but it might be of some interest to mention the advantages of the system to the architect in designing. We have stressed in the Bulletin the importance of an analytical and methodical approach in the first instance, so it follows that the colours themselves should be examined analytically. Many colour choices are inappropriate because they are regarded as either red, or blue, or pale and dark and that is about as far as analysis goes. One should, of course, compare the relative properties of all colours under consideration. Is this colour of a higher reflectance than that one, is this blue redder or greener than that one, is this colour of stronger chroma than that one. Munsell, by expressing colours in the three attributes of hue, value and chroma, enables architects for the first time to compare the relative properties of colours and select them analytically. It is a system which is particularly attractive to architects because it encourages a methodical approach without in any way inhibiting final choice of colour or making any pretence at prescribing colour schemes.

Without Munsell one has to think of all the attributes of colour at once, which is difficult and confusing. From what I have said earlier in this talk it is clear that one can design in terms of reflectance only, leaving chroma and hue for separate consideration. Reflectance it seems to me is very largely determined by the conditions that already exist in a building and can be reasoned fairly closely. Chroma to a lesser extent is predetermined, and hue is even less so. It is for the choice of chroma and hue that the designer's own imagination is chiefly responsible, and it is here that the character and the kind of feeling and emotions the scheme will arouse are largely determined. Whether a colour scheme is jolly, restful, dignified, cold or warm is determined largely by hue and chroma choice together with the scale and character of the pattern as manifested in terms of form, colour and light. We must be grateful to Munsell for helping us to sort out the complex problem in this way, and if there are still many unknowns, we are beginning to know what we know, and know what we don't know.

It is on the effect and use of chroma and hue that more colour knowledge and experience is particularly required, and I hope that research workers will consider this in the future.

Discussion

MR. W. ALLEN: I have particular pleasure in opening this evening's discussion because it gives me a chance to acknowledge a personal debt to Mr. Medd which I feel many architects probably share. He spoke of the problems that faced him at the beginning of that big school programme in Hertfordshire, but to those of us watching him he moved with an almost scientific sureness and with nerve enough to use the whole gamut of colour, in all hues and from black to white. I do not know of another architect who could have used these colourings so extensively, and Mr. Medd has well justified his venture by his results; he has done a great service for both our professions.

One thing which has always interested me in Mr. Medd's approach is the way he relates his colouring to his lighting in a design. All the way along, from sketch plan onward, he seems to think of his colours as attributes of structure in much the same way as he might think of strength, or thermal insulation. One of the main lessons that he has to teach is that you do not think of a design and then subsequently think of decoration. The decoration is half thought out and all the foundations laid for it in the original design.

It may be that in 20 years' time someone will come along and introduce a paper on the redecoration of some of Mr. Medd's schools. That would be interesting because

we see a great deal nowadays of schools and other buildings being redecorated in a manner that is much influenced by him, and while they are on the whole very successful, I do not think many of them have the real power of the design which has been thought out for structure and colour in the one mind at the one time.

He spoke of being analytical and methodical about colour (which is interesting when you consider what an artist he is), and it makes me think of the way in which we are moving now with the aid and outlook of science to make colour more teachable and communicable. But now that we are getting the matter tied down in this way, does this add or detract from the power of the artist? I believe Mr. Medd's opinion would be interesting. I do feel that at least the subject becomes in this way more teachable.

He did not speak in his paper of the effect of this sort of decoration upon the people who use these buildings. I have children at some schools that Mr. Medd has had a hand in, and I can speak from personal experience, therefore, when I say that the effect on the children as well as on the teachers is not only marked, but quite remarkable. I spoke to the headmaster of one of these schools after he had been there about six or eight weeks and asked what his reaction was. He said that there was a big effect which he could only describe by saying they felt buoyant all day. He tells me now that the effect goes on developing, and it seems that even the teaching methods of the school are changing, probably partly due to the liberalising effect of being under this colour stimulus all the time.

The effect upon the children is unquestionably very good. You find that areas of white which go right down to the floor are still white after two or three years, and that maintenance, which used to be greatly feared as a problem, is minimised by care the children take of the buildings. We have found the same effect in colourful factories. In fact it is one of the architectural rediscoveries of our times that good deisgn has the effect we hope for.

MR. J. M. WALDRAM: During the war I had the great privilege of working on some camouflage problems in collaboration with artists. It was most stimulating to meet a group of men who approached the problem from quite a different point of view, and talked another language from ours. In listening to Mr. Medd talking in much the same way about problems which are interesting to both our professions, I have recaptured the thrill.

It is clear from his discourse that we must design the visual field as a whole—colour, artificial lighting and architecture—and that one man must do it. I made a plea some years ago for the training and development of people whom we could call lighting artists; we have one in Mr. Medd, who has come to the problem from the architectural side, and I think there are men coming to it from the lighting side. But both need to know a great deal more about each other's job.

This paper is a refreshing contrast to one, putting an American point of view, which was given at our last summer meeting by Mr. Logan. He said that in selecting decoration colours he went through the whole gamut and struck out any which anybody thought about strongly, either well or ill. He thus compiled a series of colours which were unlikely to cause any comment, good or bad. This seems to me to be an entirely negative approach. Mr. Medd mentioned "brightness engineering"—a term which is not new and which did not originate in America—and I would like to assure him that a good many lighting engineers in England have not swallowed it whole, but are thinking about it constructively and may have some useful contributions to make to it.

An earlier paper by Dr. Nelson before this Society some seven years ago made a great beginning on this subject, about which we now know much more. In that paper he also stressed the importance of the Munsell system and he gave us some working rules which are not bad as a beginning. However, rules give one way of designing a scheme, but not the only way and not necessarily the best way. The real artist transcends

all rules. I have tried to design schemes myself, but I am no artist and I have learned from my mistakes. Only then can one appreciate the extraordinary skill of those who are masters of the art.

I would like to welcome especially the " Archrome " series of colours. The choice of colours is a most difficult business; the only colour cards are the trade cards and the B.S.I. cards which do not seem to be organised on any system and do not provide the colours one wants. The Munsell chips are certainly most useful when either recording or designing a scheme—if you can get colours made up to them.

I have learned that any departure from " safe " colours is going to cause comment, sometimes critical, and if you depart from the conventional you have to be both bold and wily.

I also learned that you have to take the greatest care in giving instructions to the painters. One may specify a gay colour for woodwork in an office, intending it to be used only on window frame, door and architrave. But I have seen a suite of offices so decorated, in one of which one wall was a wooden partition on which the same colour was used with horrible results. If you use a strong chroma, say more than four on the Munsell Scale, you have to be very careful where it is used and must keep its area small, unless you have Mr. Medd's skill in using the more saturated colours.

I have found myself, and probably this is an entirely personal matter, that the associations commonly ascribed to colours such as the idea of blue being a cold colour, are very tenuous, and would be glad to hear whether others find it so.

Can Mr. Medd tell us how we can achieve colours which are exactly to specification? Even when the correct colour has been obtained on the trial piece, on the wall it is often significantly different: and batches of paint nominally of the same colour are not the same. This is the more important as colour is more daringly used, for the precise shades are vital. Can this situation be improved?

Mr. Medd's work was on schools where artificial lighting is not used very much, but the effect of artificial light on colour schemes is very difficult to forecast. I found, for example, one pale blue-green was almost entirely killed by a certain colour in the fluorescent range.

I wonder whether we are right to make a series of near-white fluorescent lamps with pinkish colours for " social " interiors. There is reason to think that we might do better to concentrate on a really good white, and to get the " social " or other effects by the colours of decorations. For if we flood the interior with, for example, a pinkish light, the eye adapts to it and the white point shifts, so that pinks tend to look white. If we use a white light and warm coloured decorations we are on surer ground. Even then, the idea needs using with discretion. For example, there are restaurants in which a most attractive effect is produced by the use of very pale blue walls, which tend to send the white point into the blue; the food and polished wood furniture then tend to look warmer and more attractive. With pink walls the reverse occurs, and one feels rather that one is in the oven.

Finally, there is the complex and important effects of the reflection properties of the decorations which we use. The reflection factor of a surface determines:—

(i) The luminance of that surface,

(ii) The contribution which that surface makes to the illumination of other surfaces,

(iii) The contribution made by that surface to inter-reflection in the room.

Mr. Medd has rightly taken the effects in that order, which is the important order. Illuminating engineers have too often reversed the order of importance.

MR. A. E. HURST: Mr. Medd has shown us how to use bright colours in large areas and Mr. Allen said that he condescended at times to use white. I think Mr. Medd will agree with me that it is because he uses white so readily that his schemes

are so successful, and that white and pale grey are really necessary neutrals in these schemes where colours of such strong chroma are being used.

I think I am right in saying that Mr. Medd sometimes used dark colours on the window wall and at other times white or other light colours. I would like to know his reasons for this.

Regarding the standardisation of colours, I think there is a committee sitting at the moment which is wrestling with this problem. As paint manufacturers, we do know the difficulty of supplying colours to the architect's specification, and we are very interested in the Munsell range. But the paint manufacturer not only has requests from architects for Munsell colours, he also has requests from people who specify B.S.I. and B.C.C. colours; in addition each of the Services has its own special range, as do many County Councils and so on, so that the paint manufacturer really has a very difficult problem.

DR. J. W. STRANGE: I gather that this paper will be published; I have had the pleasure of reading a pre-print and I would like to add the comment that I think it is even easier to read than to listen to.

I was immensely impressed by the pre-print because one could detail the points which Mr. Medd made. So often in this type of discussion dealing with qualitative matters one is left at the end with a pleasant glow, but half an hour later there is nothing left.

In contrast to Mr. Waldram I have found that trying some of these schemes at the place where one works can have interesting effects. Partly encouraged by the Hertfordshire schools and partly by an enthusiastic architect, we used some of the experience mentioned to-night in a new laboratory building into which we recently moved. The general effect is one of great visual interest and pleasure to all concerned. When most of my colleagues saw the original plans, I think they felt that instead of the colours "singing" there would be a very discordant chorus. However, by using Mr. Medd's precept of isolating bright colours with greys or near whites, a very favourable effect has been obtained.

Mr. Waldram mentioned Mr. Logan's paper. I was so interested in the contrast between the two papers that I looked up some of Mr. Logan's words. He recommended the use of colours of a light or even neutral emotional response in all conditions for general work surroundings so that there should be "no loss on energy draining channels of emotional responses!" I feel that the stimulation that we get from colours, even in our work areas, is vastly to be preferred.

The question of artificial lighting has been mentioned. When these slides were shown at an earlier meeting of the Colour Group of the Physical Society, the comment was made that these buildings were used little at night-time and so artificial lighting was not a major factor in the design. I looked with particular interest at all the slides to-night to see what attention was paid to this, and I must admit that I did not see much. These new ideas present some interesting problems to the lighting engineer, one being the influence of fluorescent lighting on such colours. In terms of the C.I.E. Colour Co-ordinates, colours above the black body locus should be avoided; in other words, particularly when dealing with near whites on large areas, anything with the faintest tinge of green should be avoided. In fact it is essential that under these circumstances pale shades of pink or reddish tinges should be used.

MR. BRUCE MARTIN: Mention has been made of the importance of white. It seems to me that even more important in this respect is the adequacy of light whether it is natural or artificial. Colours, in fact, do not "sing" in the dark, they require light in order to "sing."

The best way of communicating ideas on colours is to show colours. We must

show colour to the very best advantage and I would suggest that one of the ways of doing it is to put the light into the best places.

MR. A. G. PENNY: As an engineer I, and some of my colleagues, have often expressed the difficulty of finding the basic purpose behind the decorative side of an architect's work. As engineers we think we have a very clear idea of our purpose, and are quite firmly convinced that we are trying to do something to help the community as a whole. We have a real confidence in having a continuing purpose, and most of our work is built on the work of our predecessors. We have a very high regard for earlier engineers and it always comes as a bit of a shock when architects, such as Mr. Medd, mention the work of the Victorian architects with such disfavour. I gather that they started what was then a new system of decoration on a very modest scale, and as they became more familiar finally ran riot, whereupon that method of decoration went out completely. Now I observe Mr. Medd starting on the same way. Cautiously approaching the new idea of decoration by colours, he is now well in his stride and in due course I suppose (when everyone else in the architectural world catches up) there will be a real riot again and colour will be out completely. Thus far we can see where the architects are going—but where do you imagine you are going when you get to that state of affairs ? Will you once again throw over all past practice and start anew ? How much do you feel you are benefiting the human race by this continual change of direction ? It is this difficulty of seeing whether there is a basic continuing purpose behind the architectural approach to decoration that baffles me.

MR. L. K. WATSON: I have looked forward to the publication of Building Bulletin No. 9 because for the last two or three years there have been so many different ranges of colours available, some almost alike. I would like to draw attention to one practical difficulty that I have met and that is how to describe a colour. When letters and numbers are used, as with Munsell colours, I have found that I also have to invent a name because on the job if a label is slightly inaccurate or gets lost, the wrong colour might be applied. I would like to ask Mr. Medd if his committee have considered the choice of names for colours because I do not feel that figures and letters alone are enough.

I would like to see some reference in the colour to the pigment from which it had been obtained, although there may, of course, be some technical difficulty why this cannot be done.

MR. T. MITCHELL: I am sorry that Mr. Watson did not take up the speaker before him. I can only say most emphatically that he must be colour blind or else lacking in the secretions which give rise to the experience that one is faced with in colour. It is like being tone deaf. I am certain that is the answer.

One of the difficulties about colour at night is gauging the effect of the combined use of fluorescent and tungsten lamps on colours. It is not easily done in the office; it is not easily done anyhow except by getting up on the job, and very often when there are big surfaces to deal with this is not very practical

The combination of tungsten and fluorescent lighting which in itself is a very pleasant combination can be used to give a quality and effect which neither light by itself possesses, although their use may lead one into particular difficulties with colour.

MR. R. R. HOLMES: At a recent meeting a complaint was made that the lighting of certain parts of a power station was too flat and that the effect was too dull for men on long shifts. With the colours suggested by Mr. Medd there is no possibility of the eye being bored because you can turn to a different part of the visual field.

Many buildings may look very well in sunlight and in fine weather, but if the weather is dull the building is dull and loses all the light and shadow which the architect

had hoped would give his building tone. The use of colour seems able to give that relief in the visual field for which we have been looking independent of the weather.

MR. S. S. BEGGS: I am not an artist by any means. Mr. Medd has given us a lot of illustrations and examples, but I am afraid that in what he has said I find it difficult to see the thread of his reasoning.

I come to a paper like this in an earnest endeavour to understand more about colour and artistry, for I think it is essential that the engineer should have an understanding of it. I do not think there will ever be one man who is expert in both sides, and I think, therefore, that it is necessary for the engineer to understand the language of the artist and the architect.

I agree with many of the illustrations shown, although sometimes I wondered if light and dark shades might not be equally effective as colour; but Mr. Medd has confused me by sometimes showing one arrangement and then another almost the reverse. I am sorry that Mr. Medd has not made the basis of the application of colour very clear to me. For example, in one instance a large blackboard apparently was a bad thing, but in another the lack of it to form a centre of interest in contrast to the walls was also a bad thing.

Is there any hope of there being a Primer in colour techniques for the engineer?

MR. MEDD: First, I would like to say that the work which I have been talking about is really part of a group effort between a number of architects, Mr. Allen's colleagues at the Building Research Station and paint manufacturers, some of whom I see here to-night, and I hope your appreciation will be extended to all who deserve to share it.

Mr. Allen, in asking how the artist is affected by the development of method in colour scheme design, raises an interesting subject. Colour scheme design is a form of applied art, so that the designer has to conform to a number of conditions that do not arise from his own invention. He has, therefore, if he is to satisfy others as well as himself, to study the conditions and requirements of the situation. He is not free, like a painter of an easel picture. The mural artist, too, must understand the architect's conception to be able to clarify and express it. He must exploit the opportunities of the situation and turn limitations to advantages. It is, therefore, a form of applied art to which analysis and method must be added.

I felt sure that the effects of colour on users would be raised, and I wish that it was somebody's job to determine the effect of colour on people. It is a most important bit of research work that should be done. It certainly wants doing methodically and scientifically over a long period of time. From chance remarks of teachers and children we have formed an extremely encouraging impression, but we have no real documentary evidence on the subject.

On the question of preservation of these colour schemes, I find it most encouraging to go back to schools which were decorated four or five years ago and to see in many how carefully and how well kept the school has been. White walls which come right down to the floor are preserved perfectly, and this is extremely encouraging. I believe fresh, clean and stimulating colours encourage respect for environment.

Mr. Waldram emphasised the importance of considering the interior as a whole, and that is something with which I thoroughly agree; I also agree that the American approach is that they are so worried about causing any harm that they run the risk of never doing any good. That applies, of course, both to lighting and colour.

Mr. Waldram also said that departure from green and cream is bound to cause comment—so will adherence to green and cream.

The use of bright colour is only one aspect of colour design; it constitutes the

most dramatic departure from previous uses of colour, but the main function of colour is the very serious one of making interiors comfortable and efficient to work in.

What makes a school such a good building type for the demonstration of the contribution of colour is that it contains under one roof spaces for violent activities and movement, spaces for community activities, spaces for study and concentration, and domestic spaces, each of which demands a different colour treatment.

The question of colour matching was raised. I would like to pass that straight to the manufacturers.

The problem of the effect of artificial light on colour is one which we do not have to face in schools. If we had to face it we should have had to do something about it. It is a most important subject for future study on our part.

Mr. Hurst emphasised the essential use of white. Of course I agree with that, and the only reason why one can make these bright colours work comfortably is by the extensive use of white. If strong colours are used in the way one uses pastel colours, the effect will be devastating.

Mr. Hurst also mentioned the use of both light and strong colours on window walls. As a general rule there should be light colours on the window walls, except when they are strongly illuminated from another source.

The number of colour ranges to which he referred is a problem which both the paint manufacturer and the architect has to face. That is partly because nobody has really sat down to design a colour range to serve the purpose for which it is to be used. The " Archrome " range is, I think, a useful beginning.

I am not going to answer Mr. Penny's remarks about why architects decorate interiors. I can only say that he should try working in an unfinished building—then he might think there was something in the architect finishing it off.

Like Mr. Penny, I have a respect for my professional predecessors. I deliberately implied that Victorian architects had something to teach us, just as did those architects who reacted against Victorian excesses. The progress of architectural tradition is as sure as that of engineering, but it is more difficult to recognise as it is complicated by superficial and capricious influences in a way that engineering is not, which is concerned more with technique than with people and taste.

I did not mean to be scornful about Victorian architects but I think we are trying to bring more visual interest into design than some of the more puritan twentieth-century architects have done.

Mr. Watson talked about the difficulty of describing colours on site. This can be extremely confusing and I think the simplest way is to have a serial number for each colour. My experience is that when talking casually about a colour on a job it is easier to talk about 1 and 6 and 23, etc. This is one advantage of having a small range of colours.

The question of being able to specify pigment in colour is extremely complicated and not practical for everyday use.

It was suggested that we shall never get one man to deal with both sides of the problem—colour and architecture on the one side and lighting on the other. That is the difficulty of being an architect—there are so many fields that one must know about. The architect should put himself in a central position to co-ordinate the many specialists concerned in the design and erection of a building. He should be able to talk intelligently about every aspect in order to get the best out of, and the best balance between, specialists. He should be a jack of all trades.

I am sorry Mr. Beggs is so confused. That is my fault. The difficulty is that sometimes a particular solution is the right one and sometimes it is the wrong one. I hope he finds the Building Bulletin helpful.

Annual General Meeting

The annual general meeting of the Illuminating Engineering Society was held at the Royal Society of Arts, John Adam Street, London, W.C.2, at 6 p.m., on Tuesday, May 12, 1953. The President, Dr. W. J. Wellwood Ferguson, was in the chair. The Secretary having read the notice convening the meeting and the statement of the auditors for the past year, it was agreed that the minutes of the last meeting be taken as read and were approved.

Report and Accounts for 1952

The President then presented the Report of the Council for 1952. (See *Transactions*, Vol. XVIII, No. 3, 1953.) The President said that the activities of the Society in London and in the Centres and Groups had been well up to the standard of previous years, but pointed out that to maintain interest in meetings more papers and lectures of wider interest must be offered for presentation. It was necessary also to encourage younger members of the Society to take a more active part; in this connection very successful meetings at which student members presented short papers had been arranged by one or two of the Centres and also in London.

During the year Honorary Membership had been conferred upon Prof. J. T. MacGregor-Morris. Four new Fellows had been elected but the increase in membership during the year had been very small—only sixteen. It is possible, he said, that there might be a slight decrease in membership during the present year and he again emphasised the need to widen the activities of the Society to encourage new members.

The President also referred to the amendments which had been made to the By-laws which now gave a better indication of the organisation of the Society.

Referring to education in illuminating engineering, the President said that a number of courses had been arranged in different parts of the country but that some courses had been abandoned for lack of support. He asked that every encouragement be given to young men and women in the industry to take these courses. He also referred to the number of Student Members of the Society which though it had increased during recent years was still very small.

During 1952 the first Dow Prize Competition had been held. The details of the competition had been worked out in co-operation with the Royal Institute of British Architects and the Institution of Electrical Engineers. The President expressed the thanks of the Society to these bodies and to the assessors for the time and attention they had given to the competition.

Referring to the financial position of the Society the President pointed out that the Society had finished the year with only a small excess of income over expenditure. He said that the Council had the question of finance constantly before them. He pointed out that investments were now shown in the balance-sheet at their market value.

The adoption of the Report was proposed by Mr. E. G. Wotton, who also expressed a vote of thanks to the President, Officers and Members of Council for their work on behalf of the Society during the year under review. The adoption of the Report was seconded by Mr. R. R. Holmes, who supported the appeal by the President for more papers from younger members of the Society. He also expressed some disappointment at the attendance of Centres representatives at Council meetings and expressed appreciation of the work done by the editors of the Society's publications.

The Report was carried unanimously and the President returned thanks on behalf of the Officers and Members of Council.

Election of Officers and Council

The President reported that after the publication of the names of Council's

nominations to fill vacancies on Council from October next an independent nomination had been made. In accordance with the Articles of Association a ballot had been held as a result of which the following were declared elected: Mr. N. Boydell, Mr. C. Dykes Brown, Mr. T. Catten, Mr. H. Hewitt, Mr. H. G. Jenkins, Mr. W. Robinson, Dr. W. S. Stiles and Mr. D. A. Strachan.

There had been no other nominations for Officers and the following were therefore declared elected:—

President:—Mr. W. R. Stevens.

Vice-Presidents:—Mr. H. G. Campbell, Dr. W. E. Harper, Mr. A. H. Owen, Mr. J. F. Stanley, Mr. W. J. P. Watson.

Hon. Treasurer:—Mr. E. B. Sawyer.

Hon. Secretary:—Mr. H. C. Weston.

Hon. Editor of the Transactions:—Dr. W. E. Harper.

This concluded the formal business of the meeting.

Address

The President then introduced Mr. D. C. B. Maclurcan, who gave an address in which he spoke of the organisation of the Illuminating Engineering Societies in Australia and drew some comparisons between lighting practice in that country and that in Europe. In his introductory remarks the President welcomed Mr. Maclurcan as the immediate Past-President of the National Council of the Illuminating Engineering Societies of Australia and as the first visitor from Australia to give the annual address to the Society. A vote of thanks to Mr. Maclurcan was proposed by Dr. J. W. T. Walsh and seconded by Mr. W. Allen.

Additions to the List of Members

The following applicants have been duly elected by the Council to membership in the Society, and their names have been added to the list of members:—

SUSTAINING MEMBER:—

Pearce & Cutler, Ltd .....*Representative*: K. P. Cutler
Bridge Street, Broad Street, BIRMINGHAM.

CORPORATE MEMBERS:—

Birchenough, F. J. .....23, Hillside Avenue, Whitefield, MANCHESTER.
Bradley, A. R. .....15, Hall Lane, Chingford, LONDON, E.4.
Cope, R. W. .....7, Whitehall Road, Woodford Wells, ESSEX.
Evans, W. A. J. .....37, Tanybryn Street, Aberdare, GLAMORGANSHIRE.
Galley, A. V. .....Carlton Lawn, Carlton Street, CHELTENHAM.
Gay, J. R. R. ....."Yetholm," Well Meadow Drive, Copthorne, SHREWSBURY.
Grant, F. R. .....Flat 3, 31, Rutland Street, LEICESTER.
Harrison, T. A. C. .....4, Oak Avenue, Shirley, Croydon, SURREY.
Haver, Miss G. L. ....."The Firs," Forest Side, Epping, ESSEX.
Horrobin, S. R. .....14, Greenbank Avenue, Hall Green, BIRMINGHAM, 28.
Johnson, P. B. ....."Salcombe," Melton Road, Tollerton, NOTTINGHAMSHIRE.
Patterson, C. A. .....8, Warren Crescent, Bury Street, LONDON, N.9.
Ranger, P. F. .....18, Totley Lane, Bradway, SHEFFIELD.
Roberts, H. W. .....21, Lynthorne Road, Frizinghall, BRADFORD.
Rothery, F. .....65, Blue Hill Lane, LEEDS, 12.
Smith, J. S. .....5, Bath Terrace, Tynemouth, NORTHUMBERLAND.
Watson, F. M. .....4, The Grove, Uplands, SWANSEA.
Wild, E. H. N. .....259, Moorside Road, Swinton, MANCHESTER.
Wray, L. .....22 Larne Crescent, Sheriff Hill, GATESHEAD, 9.

OVERSEAS MEMBERS:—

Kern-Hansen, C. E. .....Slotsgade 5, Hillerod, DENMARK.
Topjian, B. S. .....P.W.D. Kuwait, PERSIAN GULF.

ADDITIONS TO THE LIST OF MEMBERS

STUDENT MEMBERS:—

Deacon, G. D. .....30, Montrell Road, Streatham, LONDON, S.W.2.
Henbest, M. J. .....33, Ribbledale Road, Mossley Hill, LIVERPOOL, 18.
Humbles, B. .....6, Glenwood Road, Tottenham, LONDON, N.15.
Taylor, B. .....28, Wightman Road, Harringay, LONDON, N.4.
Townsend, B. .....14, Kirkstall Avenue, Tottenham, LONDON, N.17.

TRANSFERRED TO CORPORATE MEMBERSHIP:—

Middleton, E. ....."Edelweiss," Bakers Lane, SUTTON COLDFIELD.
Wilkinson, C. G. E. ....."The Rigs," 207, Coventry Road, Nuneaton, WARWICKSHIRE.

Fellowship

The Council has accepted the following application for Fellowship of the Society:—
Mr. H. Hewitt.

Register of Lighting Engineers

The Council has accepted the following applications for inclusion on the Register of Lighting Engineers:—

Mr. E. C. B. Morgan.
Mr. D. Sculthorpe.

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